A Study of the Desert Tortoise (Gopherus agassizi) in the Chuckwalla Valley

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ABSTRACT

In the Chuckwalla Valley, Riverside County, California, a study of the desert tortoise, Gopherus agassizi, was conducted from late March to late May, 1978. Two sites were studied for a total of thirty-two days. The first site yielded no sign of the desert tortoise. On the second site five live tortoises were found. There were four males and one female; four adults and one subadult. These were marked. Nine separate remains were found. The few burrows found were located either in the side of a wash or in Spermophilus burrow complexes.

Factors such as heavy vehicular use, sheep grazing and a natural low perennial shrub diversity are briefly discussed.

INTRODUCTION

A desert tortoise (Gopherus agassizi) study was conducted in the Chuckwalla Valley of the Colorado Desert, Riverside County, California for thirty-two days within a time period from late March, 1978 thru late May, 1978. The objectives were to determine the status of the desert tortoise in the Chuckwalla Valley and to collect data on the tortoise population.

STUDY AREA

Two study sites were chosen. The first (Sidewinder Well quadrangle, 15', T5S, R18E, section 11) is hereafter called Chuckwalla Valley I (C.V.I). The second (Sidewinder Well quadrangle, 15', T6S, R18E, sections 10 and 11) is hereafter called Chuckwalla Valley II (C.V.II). Both are approximately twenty five miles west of Blythe, California.

Chuckwalla Valley I (fig. 1) was located near the northwest corner of Ford Dry Lake and had an average slope of 0.05%, south-southeast aspect. The elevation was 3700 feet, on the average.

C.V.I had a low perennial shrub diversity. The creosote bush (Larrea divaricata) was dominant with the average plant large (up to six meters in diameter) and with dense foliage. The bursage (Ambrosia dumosa) was the next most common perennial, the plants being small and showing a somewhat patchy distribution with highest densities at the northern and mid-eastern areas of the section. Other perennials included brittlebush (Encelia farinosa), cheesebush (Hymenoclea salsola) and galeta grass (Hilaria rigida) which are all most common along the north boundary of the section. Spring annuals were abundant this year. (See appendices I and II for complete plant species lists.)

The ground surface of this section was about half desert pavement

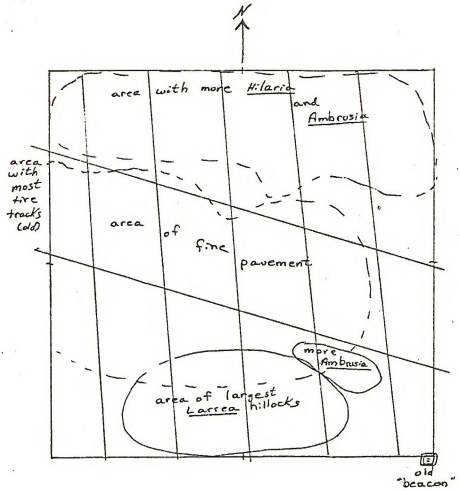

Figure 1. A schematic diagram of the Chuckwalla Valley I site. (Sidewinder Well 15', T5S, R18E, section eleven).

cut by very shallow, sandy washes. There were very few rocks. Many of the creosotes presented definite hillocks up to a meter high and penetrated by burrows of badger (Taxodia taxus), kit fox (Vulpes macrotis) and round-tailed ground squirrel (Spermophilus tereticaudus). There were numerous vehicle tracks, many of them large and old (possibly remnants of the 1942 "war games" of General Patton). Most of the recent tracks ran in a west-northwest to east-southeast direction. There was no evidence of sheep grazing this spring but old sheep scat was common.

Chuckwalla Valley II (fig. 2) was located south of Chuckwalla Road. This site consisted of two square miles and had an average slope of 0.05% with a north-northeast aspect. The site was dissected by numerous small, shallow, intertwining washes. The elevation was 520ϕ feet. average.

The vegetation of section eleven can be described as separate wash and interwash areas. The largest washes were lined with large ironwoods (Olneya tesota) and cheesebush. The interwash areas of section eleven were Larrea/Ambrosia scrub with scattered Encelia, Hilaria, Olneya and ocotillo (Fouquieria splendens). The ground surface was sand washes and bare dirt with scattered rocks in the interwash areas.

In section ten the wash vegetation was similar though some of the washes were up to one half meter deep and often rock lined. The interwash areas were closer to pure Larrea stands. The ground surface was rockier, mostly desert pavement with large areas devoid of vegetation altogether. Several other perennial species were represented along the washes although in very low numbers. The annual bloom was good this year and fairly similar to C.V.I. (See appendices I and II for complete plant lists.)

There is heavy evidence of human activity on C.V.II. In addition to many vehicle tracks, old and new, within the sections, there was an

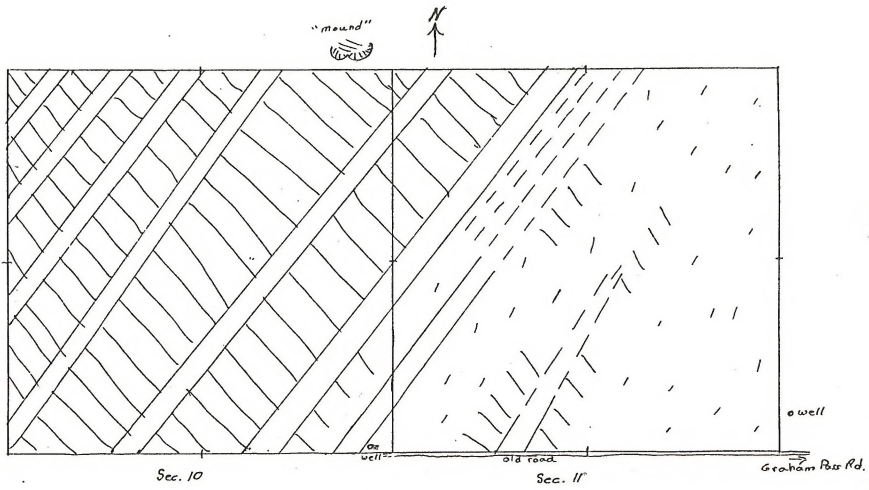

Figure 2. A schematic diagram of the Chuckwalla Balley II site. (Sidewinder Well 15', T6S, R18E, sections ten and eleven). The diagonal lines indicate the major washes which flow from SW to NE.

= desert pavement areas

old road running along the south boundary of section eleven. Near both south corners of section eleven were old, deep water wells, lined with pipe, thirty centimeters in diameter. Also at the corners one could see that the ground had been cleared, probably by bulldozer, some decades ago. Shrubs had begun reinvasion of these areas; the Ambrosia appeared to be the pioneer species. Along the old road the Encelia were especially dense. Litter was common, old and new. There were large and small army ration cans, rusting, half-buried. There were literally thousands of bottles- beer, soda and wine- especially in section eleven. There was even a small fragment of a blue balloon from Cal Worthington and his dog, Spot. Near and north of the northcentral corner marker (the marker between sections ten and eleven on the north boundary) was a large, plowed area with a "mound" of plowed dirt some fifteen meters high. Nearby, on section ten, was a stash of about one hundred hubcaps. The point of all this is that the area is, and has been for some time, used by people. The only current evidence of large grazing animals was presented by a few piles of burro scat in the large wash near the southcentral corner marker.

WEATHER

The weather offered no surprises. A summary of weather conditions including some relevent comments about the annual responses of the vegetation is found in Table I. During the early dates of the study (late March through April) temperatures would drop to as low as eight degrees Celcius at night and rise to thirty-two to thirty-five degrees Celcius during the day. In late May the night temperatures were in the twenties and the day temperatures commonly rose to forty degrees Celcius. The prevailing winds were from the west although frequent

DATE	TEMP. high	TEMP. low	WIND	CLOUD COVER	REMARKS ON VEGETATION
Mar. 24	32	14	sp	0	Good annual bloom
25	32	8	sp	0	about half over.
26	32	10	sp	0	Larrea in flower.
27	35	--	sp	0	
Apr. 9	22	6	sp	100%(sprinkle)	Annuals way down.
10	29	12	wd	0	Larrea with
11	36	16	sp	20%	flowers and
12	34	14	sp	90%(humid)	fruit. Encelia
13	32	14	wd	40%(humid)	in flower. Hilaria
14	28	--	wd	0	in full seed.
25	28	16	wd	20%	Annuals almost gone.
26	29	16	sp	0	Larrea all fruits.
27	29	20	sp	0	
28	32	20	sp	0	
29	29	20	wd	50%	
30	29	24	wd	30%	
May 1	20	16	wd	100%(rain around valley)	
2	31	23	sp	90%	
3	36	23	sp	0	
4	36	21	sp	30%	
5	35	--	sp	20%	
7	33	20	sp	0	Annuals gone.
8	34	22	sp	0	
9	32	23	sp	0	
10	33	21	sp	0	
11	34	25	sp	0(smoggy)	
12	38	27	sp	0	Olneya buds seen.
13	41	29	sp	0	Asclepius in flower.
14	41	25	sp	10%	
15	39	--	sp	0	
24	31	16	sp	70%	No annuals in bloom.
25	31	17	sp	10%	Olneya in bloom.
26	33	22	sp	60%	
27	24	23	sp	0	
28	34	--	sp	0	

Table I. A summary of weather and the seasonal response of the vegetation. Temperatures are in degrees Celcius. sp=wind from still to gusty. wd=windy all day. Cloud cover is in percent coverage.

shifts to southwest were recorded in the late afternoons. (Table I uses only the terms sporadic, sp, for days with variance from still to gusty part of the time and windy, wd, for days with strong winds.)

The sky was generally clear with at least partial cloud cover recorded on fifteen days. Only two moist periods occurred, one giving only a high humidity and the other heavy rain in the Palen Mountains and a few drops on the C.V.II site itself.

METHODS

The investigator was camped on the site on the nights and walked the milages shown in Table II. Investigations began the afternoon of the date noted in the table and continued through the morning of the day following the last date noted. Neither site was visited for a total of thirty days. After the first four days the site was changed from C.V.I to C.V.II due to a complete lack of tortoise sign noted after walking twenty-four miles on C.V.I.

No section markers were found. On C.V.I the southeast corner was the cement base of an old airport beacon. On C.V.II the southeast corner was located by entering via the old road (which leaves the Graham Pass Road three and three quarter miles south of Chuckwalla Road and runs due west) and going one half mile. This southeast corner was located near the easternmost of the two wells previously described. The remaining corners were located by pacing in compass-determined directions and were marked, permanently with rock cairns and temporarily with bicycle flags.

A summary of the transects walked in search of tortoises and tortoise sign is shown in figures 3 and 4. Most of the tortoise transects were perpendicular to the north-south and east-west compass

DATES (inclusive)	days on site		miles walked		
				C.V.II	
	C.V.I	C.V.II	C.V.I	10	11
24 Mar. - 26 Mar.	3	-	24	-	-
9 Apr. - 14 Apr.	-	7	-	-	20
25 Apr. - 5 May	-	10	18	18	26
7 May - 15 May	-	8	-	20	15
24 May - 28 May	1	3	10	9	12
	4	28	34	47	73
	32		154	120	

Table II. A summary of days spent and miles walked in search of tortoises during this study.

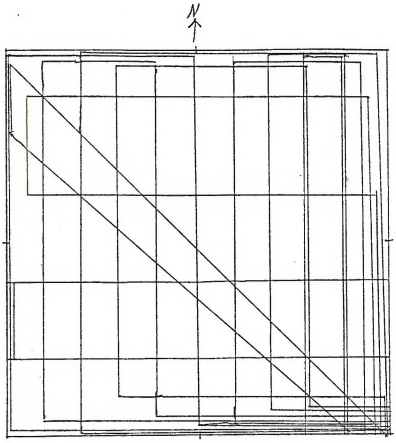

Figure 3. A schematic diagram of the milage walked in search of tortoises and tortoise sign on C.V.I.

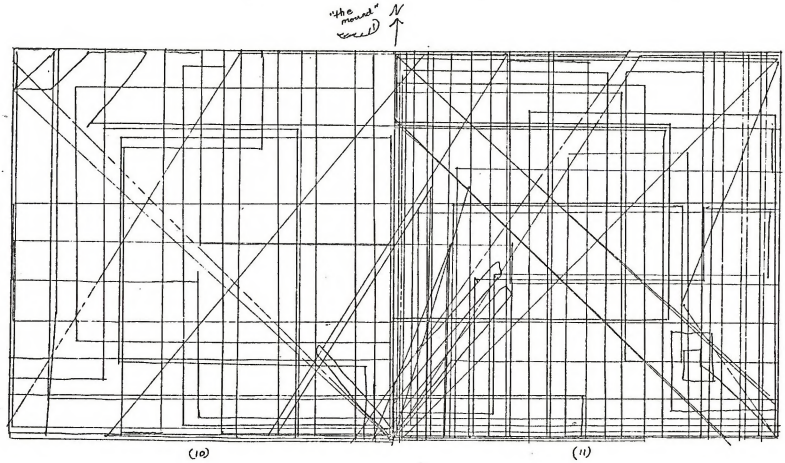

Figure 4. A schematic diagram of the milage walked in search of tortoises and tortoise sign on C.V.II.

directions except for those occasions when the investigator decided to follow a topographical feature, such as a wash, or a vegetation stand. The objective in choosing a walk pattern for a day was to give overall even coverage of the site. Most of the walks were conducted between sunrise and noon and between four P.M. and sunset.

Data was taken for each live tortoise encountered. The animal was weighed using a Chatillon Model IN-25 spring balance and a sling of parachute cord. No difference was recordable following urinations. Measurements, taken with calipers, included maximum carapace length (MCL), maximum (PLt) and minimum (PLn) plastron lengths, height (Ht) at the center of the third vertebral plate and widths posterior to the third marginal (M3), middle fourth marginal (M4), between the seventh and eighth marginal (7-8) and greatest posterior flare (GrW) which was either equal to 7-8 or at the middle of the eighth marginal.

Kodachrome slides were taken of the dorsal, ventral and left lateral views and the surrounding habitat. Rubbings were taken of the carapace on eight by eleven inch paper with a soft drawing lead. Afterward each rubbing was sprayed with Krylon. Notes were taken on sex, gular condition, shell wear, anomalies, injuries, urinations, defecations, location and behavior. Temperatures taken included ground surface temperature (Tgs), air temperature at one centimeter above ground level (Talcm) and at one meter above ground level (Talm). The thermometer was shaded during this procedure. Time (PST), wind (Beaufort scale) and cloud cover (FAA) were recorded.

Standard data sheets were filled out for each animal. Following data collection each tortoise was marked using a triangular file following the standard system of the Desert Tortoise Council. In addition each tortoise was painted on the carapace with yellow ochre light acrylic

paint using the initials of the investigator and the number of the specimen (e.g. MF-1).

Shell-skeletal remains of dead tortoises were collected after being measured and photographed. Standard data cards were filled out for each specimen. Each was given a number (e.g. MF-T1) and will be sent to the Riverside office of the Bureau of Land Management as an addition to this report.

Burrows and suspected burrows, tracks and other sign were noted, measured and plotted on a site drawing. Tortoise scat was collected. Predator scat was broken open to look for tortoise sign (none was found).

Five one hundred pace toe-point transects were completed for each site using the California Desert Project Standard Unit Record Form for Vegetation and Soil Surface Resource Field Data.

Five Point-Quarter transects were completed for each site after the method of Cottam and Curtis (1956) using data forms derived from Cox (1972). In addition to and in conjunction with these, five Canopy-Coverage vegetation analyses were performed after the method of Daubenmire (1959).

RESULTS - TORTOISES

Live tortoises:

Five live tortoises were found, all on the C.V.II site during twenty-eight days and one hundred-twenty miles walked. Their locations on the site are plotted on figure 5. Their data is recorded in Table III. No recaptures were made.

Given a sample size of five, statistical analysis seems improper. The results are presented in a purely descriptive format.

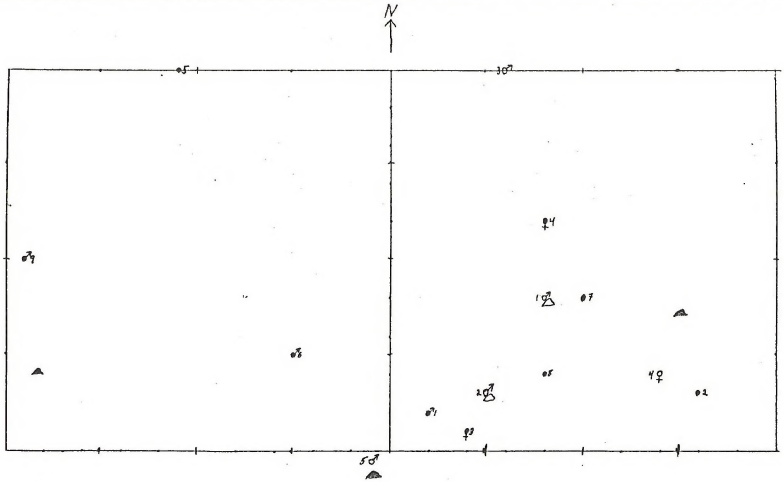

Figure 5. C.V.II. Locations of tortoises, tortoise remains and tortoise burrows found during this study.

♀ live (sex and number indicated)

♂ remains (number indicated, sex indicated when known)

tortoise burrow

suspected tortoise burrow

				MEASUREMENTS mm							
DATE	SEX	#	Wgt.(kg.)	H	CL	PLn	PLt	M3	M4	M7-8	flare
13 Apr.	M	MF-1	4.0	117	269	138	164	177	187	202	202 (7-8)
14 Apr.	M	MF-2	2.5	103	234	217	241	143	158	165	170 (post 8)
26 Apr.	M	MF-3	1.8	92	209	191	204	133	145	146	153 (mid 8)
28 Apr.	F	MF-4	3.3	111	247	221	245	164	183	193	206 (mid 8)
28 Apr.	M	MF-5	3.4	115	247	232	250	175	185	196	198 (mid 8)

Table III: Data on live tortoises found on C.V.II.

The adult:subadult ratio was 4:1. No juveniles or hatchlings were found. The sex ratio (male:female) was 4:1. No evidence of predation or parasitism was seen. All five urinated during (or even before) handling. The urine was either clear yellow or contained a white flocculate. Two defecated and the scat was saved. (See appendix V.)

MF-1 (found at 8:30 AM) was the largest male. He was found in the SW ¼ of section eleven. He was spotted from a distance of thirty meters as he fed upon annuals growing in an open interwash area. He quickly "disappeared" into the ground. Running up, the investigator grabbed him as he was entering his burrow (described below). His mouth was stained with vegetation. His gular glands were enlarged. His nuchal scale was skewed to the left. His shell showed moderate wear and no noticible new growth. He hissed and wiggled and urinated. When released he literally ran off leaving tracks which were also photographed. (They did not show a tail mark.)

MF-2 (found at 8:45 AM) was a very handsome small adult male from the SW ¼ of section eleven. He was less active than MF-1 although he urinated and defecated during weighing. (No change in recorded weight could be detected.) His mouth was also stained. His gulars were not noticibly enlarged. His shell was in beautiful condition and showed new growth.

MF-3 (found at 10:10 AM), a male with a MCL of 209 mm, must be classified as a subadult by convention. However I believe that he was sexually mature, an opinion based upon his having moderately swollen gular glands. He was walking west along an old tire track on some desert pavement. The loose dirt on his carapace indicated recent emergence from a burrow.

MF-4 (found at 8:20 AM) was the only female found. She was under a Larrea and was setting on top of a round hole about one quarter her own size. She defecated as she was being weighed. She was quite worn and her shell had a twisted gular and a very tiny nuchal.

MF-5 (found at 1:20 PM) was an adult male with an extra first right marginal scute. He walked into the shade of an Olneya under which one of us was sitting, reading. He was very active during the measuring and marking process. When released he lumbered away. Twenty minutes later he entered the shade of another Olneya. Ten minutes later he walked into a Larrea and remained there until dusk. He had moved about fifty meters from the capture site. In the morning he was gone.

Tortoise remains:

A total of nine specimens was found and collected. Only five were more or less entire. The other four are pieces of tortoise shell (bone). The locations of these remains are plotted on figure 5. Their data are summarized in Table IV. None of the remains found was recent. Most were positioned near shrubs on the downstream side and were partially buried in soil or litter. One shell (MF-T6) showed tooth marks at the rear, probably the marks of the canines of a kit fox or coyote. As the teeth were small and the tortoise an adult I believe that they were made post-mortem. No indication of cause of death could be discerned on any specimens.

Burrows:

No tortoise burrows (or any other tortoise sign) were found on C.V.I. On C.V.II four burrows or suspected burrows were found. These are plotted on figure 5. Their measurements are summarized in Table V. The last burrow (found on April 30th) was in the east side of a wash. There were two tunnels running straight into the side of the wash. No tortoise

				MEASUREMENTS mm						
DATE	SEX	#	AGE CLASS	CL	PLn	PLt	M3	M6	M8	Remark
11 Apr.	M	MF-T1	A	-	250	270	-	-	-	old, broken
11 Apr.	-	MF-T2	A	-	-	-	-	-	-	1 small piece
12 Apr.	F	MF-T3	A	243	221	243	163	184	182	disarticulating
13 Apr.	F	MF-T4	A	-	217	228	158	-	-	loose, parts missing
29 Apr.	-	MF-T5	A	-	-	-	-	-	-	6 small pieces
4 May	M	MF-T6	A	223	224	237	152	171	168	canine marks in rear
8 May	-	MF-T7	A	-	-	-	-	-	-	1 crumbly piece
8 May	-	MF-T8	A	-	-	-	-	-	-	1 edge piece
11 May	M	MF-T9	A	-	240	268	-	-	-	on back, buried

Table IV: Data on tortoise remains found on C.V.II.

date	burrow		height (cm.)	width (cm.)	depth (cm.)	cover (cm.)
13 Apr.	MF-1		23	26	130	9
13 Apr.	suspect		9	16.5	130	4
14 Apr.	MF-2	S	20	34	140	5
	(double)	N	18	32	40	8
30 Apr.	suspect	NNW	17	25	160	6
	(double)	NW	16	20	40	9

Table V: Summary of data taken on tortoise burrows or suspected burrows.

was found but tortoise scat was found nearby.

The first three burrows (two located with a tortoise less than ten meters away) were part of large complexes of Spermophilus burrows. They showed the characteristic slant into the entrance and then ran straight, parallel to the ground surface. Presumably the somewhat loosened soil of the Spermophilus complex allowed easier digging. It might be suggested here that the great amount of vehicular use on the site could have had the effect of compacting the soil and making burrow construction difficult.

Scat:

Two pieces of scat were collected from tortoises during measurement. The rest were found while walking the site. (See appendix V: Tortoise scat.)

RESULTS - VEGETATION

Toe-Point transects:

For each site a series of five toe-point transects was done. The location of each transect was selected to give overall representative coverage of the site. The points are three meters apart. See Table VI. The actual data sheets will be sent as a supplement to this report.

On C.V.I the results show the dominance of Larrea with an overall average of 66% composition. Ambrosia could be called the subdominant with an overall average of 33% composition. The ground surface itself is predominantly bare ground with localized areas of pavement and a good cover of litter mostly due to annuals (overall average of 29% litter).

On C.V.II the perennials show more variety with Larrea having an overall composition of 43% and Ambrosia an average composition of 50%. Larrea emerges as the clear dominant only in areas of section ten (as shown by TP-04). The ground surface here is also mostly bare ground

	C.V.I						C.V.II					
	percent composition					site	percent composition					site
	1	2	3	4	5	average	1	2	3	4	5	average
LADI	68	86	78	58	40	66.0	38	31	37	83	26	43.0
AMDU	31	12	20	42	60	33.0	53	67	50	12	69	50.2
ENFA	1	--	--	--	--	0.2	--	--	--	--	2	0.4
HIRI	--	--	2	--	--	0.4	5	1	1	2	3	2.4
HYSA	--	2	--	--	--	0.4	1	1	5	1	--	1.6
OLTE	--	--	--	--	--	----	3	--	7	2	--	2.4
B	76	52	50	14	62	50.8	47	57	45	21	66	47.2
S	--	12	18	46	8	16.8	24	15	26	52	10	25.4
R	--	--	--	--	--	----	2	--	2	13	1	3.6
L	22	34	30	36	22	28.8	7	7	11	3	7	7.0
with canopy	2	2	2	4	8	3.6	7	7	11	3	7	7.0

Table VI: Results of toe-point transects done, Spring, 1978, M. Fusari.
B = bare ground; S = small rocks; R = large rock; L = litter; with canopy means a hit point with some plant canopy overhead.

with TP-04, done in section ten, showing a higher proportion of desert pavement. Litter accounts for 17% of the hit points.

Point-Quarter transects:

For each site a series of five Point-Quarter transects was done. The results are presented in Tables Vii and VIII which show the density and percent coverage for each species of perennial shrub or tree encountered.

For C.V.I the results show that Larrea was the dominant with Ambrosia the subdominant.

For C.V.II the results indicate a closer codominance of Larrea and Ambrosia with a significant canopy provided by the Olneya. This was a slightly more diverse perennial community than C.V.I.

Appendices VI and VII contain reduced data which will allow further calculations or comparisons with other sites. (The actual data sheets will be sent as a supplement to this report.)

Quadrats:

These quadrats were done at the same time as the point-quarter transects with a quadrat sampled at every other point along the transect. The data are presented in Tables IX and X which show the frequency and the percent coverage for each annual species found within a sample quadrat.

It should be made clear that these quadrats were done in late April and May, after the peak of the winter annual bloom. Most of the specimens were already dried when the quadrats were done. Therefore the results represent the persistent annuals and can not be used to describe the entire annual bloom.

On C.V.I the common plantain, Plantago insularis, was clearly dominant Six other species were represented as Table IX shows. The basal points show the dominance of bare ground with local areas of desert pavement. No rocks were encountered at hit points.

	Transect Number											
	01		02		03		04		05		Average	
	density	%cover	density	%cover	density	%cover	density	%cover	density	%cover	density	%cover
LADI	6.11	96.8	3.59	97.0	1.99	97.8	4.00	92.7	2.61	91.9	3.66	95.2
AMDU	3.92	2.8	1.41	3.0	1.18	2.2	2.93	5.8	2.44	7.6	2.38	4.3
ENFA	0.08	0.2	----	----	----	----	----	----	----	----	0.02	0.04
HIRA	----	----	----	----	0.02	0.04	0.23	1.4	----	----	0.05	0.3
HYSA	0.13	0.2	----	----	----	----	0.04	0.1	0.25	0.5	0.08	0.2
Total	10.24	100	5.0	100	3.2	100	7.2	100	5.3	100	6.19	100

Table VII:Results of point-quarter transects done on C.V.I.

	Transect Number											
	01		02		03		04		05		Average	
species	density	%cover	density	%cover	density	%cover	density	%cover	density	%cover	density	%cover
LADI	2.92	46.0	2.98	64.0	2.02	85.0	2.82	51.0	2.11	27.0	2.57	54.5
AMDU	15.30	28.0	8.36	29.0	0.51	6.0	3.62	6.0	0.60	1.0	5.68	14.0
OLTE	0.20	16.0	0.03	2.0	0.04	8.0	0.48	42.0	1.02	70.0	0.35	27.5
ENFA	1.18	5.0	----	----	----	----	----	----	----	----	0.24	1.0
HIRI	0.20	5.0	----	----	-.-1	1.-	0.12	1.0	0.02	0.1	0.07	1.4
HYSA	----	----	0.26	2.0	0.01	0.4	0.04	0.2	0.25	2.0	0.11	0.9
DASC	----	----	0.06	3.0	----	----	0.02	0.1	----	----	0.02	0.6
Totals	19.8	100	11.7	100	2.6	100	7.1	100	4.0	100	9.05	100

Table VIII:Results of point-quarter transects done on C.V.II.

	Transect Number										Totals	
	1.		2.		3.		4.		5.			
species	f.	cov.%	f.	cov.%	f.	cov.%	f.	cov.%	f.	cov.%	f.	cov.%
PLIN	.84	11.55	.98	22.35	.64	5.85	.84	16.55	.92	7.3	.84	12.72
OLLI	.46	4.80	.14	0.60	.56	2.90	------		.30	2.40	.29	2.14
GACA	.08	0.20	.08	1.20	.08	0.20	.06	0.15	.40	1.00	.14	0.55
CRAN	.30	1.50	------		.10	0.25	.14	1.10	.14	0.85	.14	0.74
SCAR	.08	0.20	.16	1.40	------		.18	0.95	------		.08	0.51
CACL	.08	0.45	.06	0.15	------		------		------		.03	0.12
CHRI	------		------		------		------		.04	0.10	.01	0.02
Totals	18.70		25.70		9.20		18.75		11.65		16.80	
BASAL												
B	.69		.17		.83		.67		.68		.61	
S	0		.62		0		.02		0		.13	
R	0		0		0		0		0		0	
L	.31		.21		.17		.31		.32		.26	

Table IX: Results of Quadrat analysis of annuals on C.V.I. B=bare ground; S=small pebbles; R=rock; L=litter.

Tramsect Number

species	1. f.	1. cov.%	2. f.	2. cov.%	3. f.	3. cov.%	4. f.	4. cov.%	5. f.	5. cov.%	Totals f.	Totals cov.%
PLIN	.92	11.30	.82	6.20	.82	7.90	.58	7.10	.56	5.55	.74	7.61
CRAN	.44	3.30	.36	2.90	.10	0.75	.36	5.50	.36	6.20	.32	3.73
CHCA	.18	0.45	.24	3.00	.42	3.05	.20	2.45	.24	2.80	.26	2.35
CACL	.08	0.20	.06	0.15	.10	0.25	.22	1.05	.24	1.10	.14	0.55
LEFL	.16	1.15	------		.02	0.05	.10	0.31	.16	3.05	.09	0.91
ARCA	.12	1.05	.12	0,80	.12	0.55	.02	0.03	------		.08	0.49
EUPO	------		------		.16	2.80	------		------		.03	0.56
OLLI	.10	0.75	------		.02	0.05	------		------		.02	0.16
SCAR	------		------		------		.04	0.35	.06	0.40	.02	0.15
CADE	.04	0.35	------		------		------		------		.01	0.15
NAHI	------		.02	0.30	------		------		------		.004	0.06
LOTO	------		------	.02	.02	0.30	------		------		.004	0.06
CHRI	------		------		.18	0.95	------		.02	0.05	.004	0.06
DICA	------		------		------		------		.02	0.05	.004	0.01
Totals		18.55		13.35		16.65		16.78		19.21		16.85
BASAL												
B		.20		.61		.19		.53		.48		.46
S		.48		.14		.63		.12		.13		.24
R		0		.02		.09		.07		.09		.11
L		.32		.23		.09		.28		.30		.24

Table X: Results of quadrat analysis on C.V.II. B=bare ground; S=small pebbles; R=rock; L=litter.

On C.V.II P. insularis was dominant with thirteen other species represented. The basal points show the sites to be predominantly bare ground with areas of pavement and some rockiness.

Both sites show similar total coverages of persistent annuals of 16.80 and 16.85 percent respectively.

DISCUSSION

Although it is probable that more tortoises would have been found had study days been distributed more in April and less in May,I would definitely characterize C.V.II as a low density tortoise site. (C.V.I, I would dare to say, has no tortoises.) Further, given the apparent absence of juveniles or hatchlings or any signs of mating, I would suggest that it is likely to remain so or to decline.

Several factors could, especially taken together, account for this. It would occur to even a casual observer that the site has been disturbed by humans intenselyand for a long period of time. Heavy vehicular use must be supposed to compact the soil and make burrowing more difficult. Some mortality due to collapsed burrows would also be expected. Also humans have been known to show a tendency to remove tortoises for pets.

This area of the Colorado Desert has a low perennial shrub diversity which would be expected to contribute to a low tortoise density. On C.V.I a partial cause of low shrub diversity could be the proximity to Ford Dry Lake and its presumed salt accumulation. Competition for food (in the form of burro and sheep grazing) would further reduce the resources of the desert tortoise. I believe that the low shrub diversity seen is due, in part, to the natural climatic conditions in this region of the Colorado desert. I also believe that the influences of human use may have stressed a marginal habitat which cannot bear such stress without severe consequences for the native populations. I would suggest that this is an important concept in the management of the desert and its native species, such as the desert tortoise.

Appendix I: Perennial species list.

		occurrence
LADI	Larrea divaricata - creosote bush	dominant
FOSP	Fouquieria splendens - ocotillo	fairly common
OPRA	Opuntia ramosissima - pencil cholla	rare (9)
OPBI	O. Biglovii - jumping cholla	rare (8)
OPAC	O. acanthocarpa - buckthorn cholla	rare (17)
FEAC	Ferocactus acanthodes - barrel cactus	rare (1)
ASSU	Asclepius subulata - milkweed	rare (1)
SAME	Salazaria mexicana - bladder-sage	rare (2)
HYEM	Hyptis Emoryii - desert lavender	rare (1)
ACGR	Acacia Greggi - cat-claw	rare (1)
CEFL	Cercidium floridum	rare (13)
DASC	Dalea Schottii - indigo bush	rare (13)
OLTE	Olneya tesota - ironwood	common // washes
KRPA	Krameria parvifolia - purple ratany	rare (5)
ECFA	Encelia farinosa - brittlebush	common, patchy
BEJU	Bebbia juncea - sweetbush	rare (2)
HYSA	Hymenoclea salsola - cheesebush	common // washes
AMDU	Ambrosia dumosa - bursage	dominant
HIRI	Hilaria rigida - galeta grass	common

Appendix II: Annual species list. Chuckwalla Valley.
April 9 - May 28, 1978. M. Fusari

		occurence	
		C.V.I	C.V.II
MARO	Malvastrum rotundifolium - desert five-spot	X	X
CRCA	Croton californicus	X	
STSP	Stillingia spinulosa	X	
EUPO	Euphorbia polycarpa - spurge	X	X
MENI	Mentzelia nitens - blazing star	X	
MEIN	M. involucrata - blazing star	X	X
ESPA	Eschscholzia Parishii - desert poppy		X
OLLI	Oligomeris linifolia	X	X
LEFL	Lepidium flavum - peppergrass		X
DICA	Dithyrea californica - spectacle pod	X	X
CHRI	Chorizanthe rigida	X	X
CHTH	C. Thurberi	X	X
ERIN	Eriogonum inflatum - desert trumpet	X	X
ERDE	E. deflexum - buckwheat	X	X
ALIN	Allionia incarnata - windmills	X	
ABPO	Abronia pogonantha - sand-verbena	X	
PLIN	Plantago insularis - plantain		X
CUSU	Cuscuta subinclusa - dodder		X
ERER	Eriastrum eremicum		X
PHTA	Phacelia tanacetifolia - tansy-leaf phacelia	X	X
PHCR	P. crenulata - notch-leaf phacelia	X	X
NAHI	Nama hispidum	X	X
CRAN	Cryptantha angustifolia	X	X
DADI	Datura discolor - jimson weed		X
MOCO	Mohavea confertifolia - ghost flower	X	X
LOTO	Lotus tomentellus - birdsfoot trefoil	X	
DAMO	Dalea mollis - indigo	X	X
OEDE	Oenothera deltoides - evening primrose	X	
OEPR	O.primiveris - evening primrose	X	X
CADE	Camisonia decorticans - bottlebrush	X	X
CABR	C. breviceps	X	X
CACL	C. claviformis - brown-eye primrose		X
BRBI	Brandegea Biglovii		X
GECA	Geraea canescens - desert sunflower	X	X
BAPL	Baileya pleniradiata - desert marigold	X	
PEEM	Perityle Emoryi	X	X
CHCA	Chaenactis carphoclina	X	X
PALI	Palafoxia linearis	X	
MOBE	Monoptilan belloides - desert star	X	X
PSRA	Psathyrotes ramosissima - desert velvet	X	
MILI	Microseris linearifolia	X	X
RACA	Rafinesquia californica - chicory	X	
ATPL	Atrichoseris platyphylla - tobacco weed	X	X
HEUN	Hesperocallis undulata - desert lily	X	X
SCAR	Schismus arabicus		X
ARCA	Aristida californica - triple awn		

Appendix III: Reptiles of Chuckwalla Valley found between April 9 and May 28, 1978. M. Fusari

species	
Gopherus agasizzi	C.V.II
Uta stansburiana*	C.V.I; C.V.II
Urosaurus graciosus	C.V.I; C.V.II
Callisaurus draconoides	C.V.I; C.V.II
Uma scoparia	sand dunes and large washes near highway
Phrynosoma platyrhinos	C.V.I; C.V.II
Dipsosaurus dorsalis	C.V.I; C.V.II
Gambelia wislizeni	C.V.II
Coleonyx virgatis	C.V.II; Chuck. Rd.
Crotalus cerastes	C.V.II; Chuck Rd.
Pituophis catenifer	C.V.II(skin); Chuck Rd.
Hypsiglena torquata	Chuck Rd.
Chionactis occipitalis	Chuck. Rd.
Masticophis flagellum	C.V.II
Phyllorhynchus decurtatus	Chuck. Rd.
Arizona elegans	Chuck. Rd.

*Only one Uta was observed on C.V.II. They were also uncommon on C.V.I.

Appendix IV:
List of Kodachrome Slides from Chuckwalla Valley Desert Tortoise Study, Spring 1978 (Sidewinder Well 15' T5S, R18E, sec. 10, C.V.I & T6S, R18E, sec. 10 & 11, C.V.II. M. Fusari.

Roll I: (C.V.II)

11 Apr.

1. Shell MF-T1 under Ambrosia dumosa, on north side (downstream side) by a small wash.
2. View of MF-T1.
3. Habitat near MF-T1 looking south. Area is a wash complex near the largest wash on the site.

12 Apr.

4. Shell MF-T2 beneath a large Olneya tesota on north side (downstream).
5. Close up of MF-T2.
6. "
7. Habitat of MF-T2 looking south.
8. "companions" Larrea divaricata and Encelia farinosa growing together.

13 Apr.

9. Tortoise MF-1: plastron.
10. " " carapace, showing some wear.
11. " " left lateral view.
12. " " anterior view, showing gular swelling.
13. " " tracks left by running, no tail mark.
14. " " "
15. " " burrow, entrance he was escaping to.
16. " " " close up.
17. " " " "
18. " " " showing location in Spermophilus complex.
19. Shell, MF-T4, under Larrea on north side near small wash.
20. " " close up.

Roll II: (C.V.II)

1. Small burrow with tracks in section 11, SE ¼ (tortoise never found).
2. " "

14 Apr.

3. Crotalus cerastes on SE corner of section 11, in litter under Olneya.
4. " "
5. MF-2: plastron.
6. " carapace.
7. " left lateral view.
8. " "two-way" burrow.

26 Apr.

9. Crotalus cerastes under a RR tie near "the mound".
10. " " disturbed and moving out.
11. " " sidewinding away.
12. MF-3: dorsal view, note dirt on back.
13. " carapace (cleaned).
14. " plastron (note 'wet').
15. " left lateral view.
16. " habitat looking south (note tire tracks running E/W).
17. Tarantula hawks on Asclepius subulata.
18. " "
19. "Man conquers the desert" #1 (old army shoe at SW corner section 11).
20. "habitat shot" of the cleared area. Note well to the right of woodpile.